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On the Anatomy and Functions Of the Skin

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By William R. Smith

Of Virginia

The Anatomy and Functions of the Skin.

In the selection of this subject, it was first my intention to treat of it experimentally: But, owing to the difficulties to which my situation would have subjected me, & the supervention of several unforeseen interruptions, I have been prevented from executing my original plan. My reading, however, having been directed to this subject, I have determined, with a view to economise time in complying with the law of this Institution, to give some of the various opinions that have been & others that are now entertained, in relation to the structure & functions of the Skin.

I am conscious of the too great imperfection of this essay, but sincerely hope it may serve the end, for which it is alone intended. I might state, in extenuation of its defective condition, the circumstance of this being my first attempt at composition: But here I am disposed to take comfort, permitting myself to repose in the kind & liberal feelings of its judges. I should here also reflect, that

The ablest and most learned of every science did once study the rudiments of their language. By contrasting, however, your present condition with that in early life, you can not but be conscious of the gradual and almost imperceptible improvement & march of mind, and will on the present occasion, no doubt, make the amplest allowance in behalf of a medical tyro &—

Before entering on the functions of the Skin, I have deemed it fit to institute a kind of comparative examination into several of the various divisions of this organ, which have been given by the different anatomists & physiologists. To do which the more effectually & systematically, I shall first state, in a concise manner, such divisions as have from time to time been received as most correct, & which come recommended to our notice, by the high & respectable sources, whence they emanate. And in the

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second place, it will be my endeavour, in a very general way, to set forth the division of Dr Eichhorn, being the most recent, in several respects different from the rest, & as I think, very plausible. It is due, however, to the ingenuity & learning of the gentleman's views to state, that were I competent to the task, the almost prescribed limits of an Inaugural Dissertation would of itself prevent me from doing it justice: And so far from wishing, that their merits may be estimated by the result of this feeble effort of mine, I am in great fear lest I may present them in an unfavourable, if not erroneous light. But, if I have in a single point misrepresented the opinions of Dr Eichhorn, it was not my intention, and is to be ascribed to my imperfect knowledge of the French Language, through the medium of which I have gained my information. —

I proceed now to give several of the divisions of the Skin, and the most simple of them is, I think, that of M.

Chaussier. According to him, this membrane has but two distinct parts. the dermis & epidermis; the one containing all the organic elements with which it is endowed, and in which take place all the phenomena of vitality, of which it is the seat; the other being the mere inorganic or non-vital portion of it.

In the division of Cruikshank, we find the skin represented as consisting of six different membranes, or more properly speaking, layers. The Cuticle, counting from the exterior, makes the first; the Rete Mucosum is double, and makes the second & third; the first vascular layer, discovered by Dr. Thos M. Bayntham, of Virginia, and in which the small pox pustules are chiefly seated, make the fourth; the second vascular layer, separated by continuing the maceration and which renders the pores of the skin very manifest, when it is removed, makes the fifth; & the sixth & last is the Cutis Vera. Thus, continues he, five different layers will be found to lie on the

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surface of the five thin each of which he conceives to be a cuticle or an incipient cuticle. the three first are evidently cuticles either in a formed or an incipient state, and the two last are most probably forming into cuticles, which, like the second & third, are to succeed the first. The 1st or most external is continually falling off in small portions resembling scales, and this appears to be the only circumstance which favours Leeuwenhoek's doctrine that the skin is formed of scales.

Bichat has given us a division in which the skin is made to consist of the chorion or true skin the reticular body, the papillae & the epidermis. the mucous body of some anatomists or colouring matter is, according to him, to be met with in one portion of the net-work of extremely fine vessels which are found after penetrating the chorion to ramify upon its surface, and contain different fluids. The experiments of M. Gaultier would

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or to prove the existence of four distinct membranes or layers in the mucous body, alone which Malpighii regarded as a mere coat or sort of varnish covering the papillae — A varnish for which Bichat has substituted a reticular body, essentially formed of vessels and divided into two portions, independent of each other. M. Gaultier states 1st there are found immediately above the papillae a series of small vascular fasciculi which he designates by the name of sanguineous [illegible] 2nd between these [illegible] + and the epidermis is seen a black undulating line placed between two white lines one of which separates it from the first layer + forms the deep seated thin [illegible] layer composed according to him of white vessels. 3rd The black line which is placed in the [illegible] takes the name of [illegible] on account of its undulations which makes it appear as if formed of an infinite number of small concave bodies embracing the summits of the papillae. 4th finally immediately be-

[illegible] [illegible] is the second coloured layer on the superficial whitish layer, [illegible] [illegible] like the first. — The views recently [illegible] by M. Breschet [illegible] somewhat different with regard to the first layer of M. Gaultier's division of the mucous body. They do not look upon the sanguineous [illegible] constituting this layer as properly belonging to the mucous body; [illegible] [illegible] say they, [illegible] the terminations of the vessels [illegible] in the papillae & forms a part of what was formerly called the papillary body. So that according to them the layers which constitute the mucous body may be reduced in number to three. The analysis given by M. Dutrochet of the structure of the skin is [illegible] nearly as follows. 1st the dermis; 2nd the papillae; 3rd the epidermoid membrane of the papillae which is the deep-seated whitish layer of M. Gaultier; 4th the coloured layer; 5th the horny layer, which answers to the superficial whitish layer

of Gaultier's division; and 6th the Epidermis.
In the excellent & comprehensive anatomical work of Mr Horner, we find the skin represented as consisting of three laminae – the Cutis Vera, the Rete mucosum & Cuticula. He thinks however the Rete mucosum is composed of several distinct parts and has adopted the division of G. Gaultier as which is not yet the one generally acknowledged & received by the French anatomists and physiologists.

No one can fail to acknowledge that precise and exact notions in the nature & structure of the skin are of the first importance whether we wish to study its functions or acquire correct knowledge of the mode of treatment in the numerous maladies to which they are liable. The same remarks will hold with equal weight & propriety as it regards every other tissue & organ of the body. With the lights of the present advanced state of our Science to guide

him as physiological, physician will be [illegible] his is not so successful in the symptoms & treatment of his disease, by his acquaintance with the nature & structure of the part or parts that may be the seat of the morbid actions. For not be [illegible] well evident that different tissues, organs &c taking on diseased action would in all cases produce external symptoms & other signs peculiar & unvarying, from whence its nature may be detected & indications drawn for the best and most successful ~~[illegible]~~ treatment. The utility of a knowing [illegible] of its constituent parts is consequently great. This division is not only necessary for correct anatomical description but facilitates discovery & leads to just views on function, diseases & their proximate causes. From these preliminary observations I hope I have not rendered myself conspicuous to the audience that I look upon the skin as an exception when I consider it in [illegible] to the divisions of the organ [illegible] the blood & [illegible]. The theory however

practically or descriptively useful I am disposed even to deny. It is true my knowledge of anatomy is not of that extensive & minute character as will warrant me in calling in question the correctness of the divisions of the skin as given by many anatomists & physiologists - some of whom are deservedly ranked among the greatest men & brightest luminaries of our profession. But let us consider for a moment the various & numerous circumstances, which might have tended to deceive the vision & mock the understanding, as well as to bias the judgement in the experiments that led to the very minute divisions, I have reason to. What shall we say of the changes & alterations that may take place in the texture & [illegible] of the different parts of the cutaneous organ when subjected to maceration, the action of alcohol & acid likewise. The forced distention & natural contraction & change in the relative position of these parts that may be & are very likely [illegible]

about of injections. Are not these circumstances [illegible] similar remedy is also occasionally in recurring, and [illegible] instances & experiments on the subject, the sense is at least to pause sometime prior to giving an unequivocal assent to the correctness of their results. In addition to these considerations experimenters may have been biased by preconceived or most theoretical views: and to what extremes may not ambition prompt the talented [illegible] ingenious & argumentative reasoner. When [illegible] he enters the field where many of the imagination holds sway, [illegible] no longer a desire to avoid error & conduct to truth, how apt the one is to [illegible] the mind [illegible] reasons into existence. Some physiologists & [illegible] at least could not have been [illegible] in their experiments, by the laudable desire to make clear the path of error & darkness: for in their attempts, they seem but to have given a [illegible]

more the imagination for vain idle conjectures & hypothesis. It is curious to observe the various & opposite opinions & conclusions to which the different anatomists have come both with regard to the anatomy & physiology of the skin. It is strange to tell that M. Chaussier could discern but two distinct parts as composing the cutaneous organ, when M. Bichat makes three, & M. Cuvier four distinct tunics, or membranes proper, as constituting the mucous of Malpighi alone. It is this mucous of Malpighi, which, by its discoverer, was looked upon as a mere varnish covering the papillæ & by Bichat was regarded as flowing in one set of vessels, constituting a part of his reticular body, and (x in the white man) whose very existence has by several been totally denied. M. Cuvier has even asserted, that vessels enter into the composition of his deep seated & superficial white tunics. I am inclined to think, however that either the imitation in discovery or the imagination of M. Cuvier has carried him too far; or, which is most probable, he has

been deceived by the appearance of artificial products, resulting from the mode of treating the skin, on which his experiments were performed. I think that Quekstaedt has likewise fallen into error, in making his observations & reasonings on a diseased skin apply to it in a sound state. I offer these remarks with the greatest degree of diffidence; nor should I expect encouragingly, did I manifest in the least a want of that deference & consideration, which are so justly due to those illustrious men. But in this opinion, that my views have some semblance of truth or probability, I think I am supported by many experiments & observations which have been made by Dr Eichhorn a late writer on the skin. To give however these different portions of the skin or even to the mucous or cribriform, the name of membrane as some have done, I think is altogether indefensible: For it seems to me clear, that this mucous or cribriform is of a fluid nature, & which may

assume the character of greater or less consistence, as well as different appearances according to the manner & other mode of treatment which the skin destined for experiment & examination undergoes. But, of this & the two white tunics more will be said hereafter.

I will now give a Anatomical division of the Skin. It appears, says this eminent, most rational to admit of two principal layers or membranes, called, the general integuments. 1st the Epidermis. 2d the skin properly so called. I understand, says he, by the skin or rather the dispose parietis the derma & the mucous web which when united to the epidermis constitutes the general integuments. I oppose by the name of derma & mucous the derma proper as separate & distinct from the dispose parietis & the mucous of Malpighi. The derma sometimes he may be said to be composed of three portions, each of which has its own peculiar character. The inversion called the internal vascular is of a loose

[illegible] extent, the middle is more dense & more resisting; but the superior, called external vascular, is still of a looser arrangement than the inferior. Although there may not exist any well defined boundaries between these different portions of the derma, yet, if the skin cut vertically through, be subjected to an inspection by the microscope, we are enabled to see them of different degrees of density — a circumstance we think of equal importance in physiology & in the treatment of the inflammation. —

I shall pass over in silence the topographical description of the skin, as also the adipose pannicle, and go on to notice cursorily the views of [illegible] relative to the internal vascular portion of the derma. The inferior portion of the derma is intimately blended or connected with the adipose pannicle, & like it in some measure, contains numerous interstices or cavities. Those of the inferior portion of the derma, however, are more abundant & formed of a more delicate

cellular tissue than those of the adipose pannicle. These cavities, called by [illegible] lymphatic are filled with a fluid entirely different in its nature from that of the adipose pannicle. His experiments [illegible] clearly proved to be an humour very analogous to lymph & containing some albumen. They are most numerous in the back & less abundant where the derma is thinest. They are most voluminous in the neighbourhood of the adipose pannicle. We meet with them in the most dense layer of the derma, but they are small & isolated. They rarely exist in the external portion of the derma, & when they do they are exceedingly scattering. He says they can have no immediate relation with the cysts into which the bulbous extremities of the hairs are inserted as some anatomists have supposed: for they are most abundant and manifest where the hairs are few & small, and the proportion which they bear to one another he states to be as 10 or 20 is to 200. He believes the hairs in an

-planted in the external portion of the derma & here these cavities if they do exist, are few & isolated. Although their does not exist an immediate connection between these cavities & the cells of the hairs, consequently, with the immediate growth of latter he seems to think however they may have a mediate relation with this latter, phenomenon or development of the hairs. Since they contain the primipes which is resemble more or less those that enter into the composition of the contents of the cysts. these cavities do not exist in infants and it is worthy of remark that the fat in their skin as well as that of all young animals is very dissimilar to that of adults in colour consistence & chemical properties. he then asks might not the formation of these cavities be dependant or in some manner connected with the change the fat undergoes. It would continue a subject of curious & interesting to ascertain if the complete development of

these cavities be synchronous with the age of puberty; but that such an inquiry would not fail to shed some light on the conjecture relative to the possible existence of a mediate connection between these cavities & the growth of the hairs. This being ascertained we would be encouraged to investigate another point of equal if not paramount interest & importance. To know whether these cavities or rather their contents be not, in some manner, connected with that order of the exanthemata which affect man but once during life, but more especially with such of them as are to be met with most frequently in infants. The doctor would consider it a chemico-organic relation. The circumstance however of these cavities existing in the derma of every portion of the body should induce us to believe they played some grand, important part in our economy; but says Dr. E. I would venture to consider them as answering in some measure

to stimulate in the skin destined to digest the lymph, but for the abuse, which has been already too frequently made of such comparisons, in applying it to absurd hypotheses. He says if the orifices of the lymphatics be ever discovered by the means of vision, for I have distinctly seen them with my mind's eye, it will be in these cavities. It is here we ought to find them; because the lymphatics have their roots in the skin generally, & the largest of their radicles certainly border on these cavities.

On removing the internal, loose cellular portion of the dermis it will be readily perceived that the tissue of the chorion becomes more & more compact. But according to Eichhorn, its density continues to increase very little beyond the half way point, when again it becomes progressively more loose as we approach its external surface. He is here supposed to most anatomists to afford its density to be greatest most externally. In this portion we find spread out, few, if any ves-

sels carrying red blood a circumstance important in the considerations of the exanthemata.

The external loose vascular portion of the derma comes next to be considered and from its importance decidedly demands most attention; but time & space will allow me to notice but few of the particulars. The arteries & other vessels &c. &c. penetrate the middle portion of the derma without ramifying, and on reaching its more loose, external cellular arrangement, spread themselves out into a horizontal net-work of extremely fine meshes. He contends that it is improper to consider the vascular net-work as expanded on the external surface of the dermis, but that it takes place under it & in the above described portion which is no less a portion of the derma than the middle or any other. He points out the circumstances which led anatomists into this error. All the experiments causing this loose cellular structure to [illegible] & retire whilst the arteries became much more distended &c. Were we to treat, says

the internal mucous portion of the derma in the same way, precisely similar processes result.

I shall now be able to notice here his views respecting the terminations of nerves in the skin, and shall now state, in a concise manner, his conjectures relative to the termination of the cutaneous nerves. It appears to him exceedingly probable that the nervous papillæ of the tongue, nose, and nipples, may be viewed as masses or collections of nervous matter and vessels, so arranged with the nervous substance principally, and the vascular portion to consist mainly of the nutritious vessels of the nerves. In the other portions of the skin, the vessels, nerves, and nerves there, seem principally those that are requisite to excite the vessels to action. He supposes in the spinal marrow reflected functions of the parts in question. Analogy warrants him in saying, there are no nervous communications spent on the cellular tissue of the skin, and it is his opinion, that all the

nerves of the human skin, which are few in com-
-parison to what we meet with in some other parts
as the muscles &c are distributed from the vessels, without
being distributed to the proper tissue of the several
integuments. Gibbay does not seem aware that this arrange
-ment is correct & similar to what prevails in the
distribution of the nerves to the mucous mem-
-branes. —

We come now to the most external portion of the
Cutis, which is the mucous or Malpighi. This how-
-ever, is no membrane, according to Mr E. There is
a very loose & extremely delicate cellular tissue existing
& extending over the derma, into the meshes of
which is secreted this albuminous mucous fluid. It is
here in these we should look for the mouths
of the last vascular ramifications. —
The Integument considered. In the opinion of
Mr E. the Cuticle is not formed by a desiccation of
the mucous, but by an organic deposit of this matter.

For it is impossible that desiccation of the mucous surface takes place in the foetus and it is provided with an epidermis. The oxygen which is requisite for its formation in the foetus, is he thinks, without doubt supplied by the decomposition of the water of the liquor amnii. The scales that are continually falling off are due to the complete [illegible]dation of the most external portion.

On the functions of the skin.

I think we may state the functions of the skin to be as follows. It together with the mucous membrane, forms a shield or protection for the living body, from external agents of the natural world, either modifying or rendering their impressions inert. It exhales & secretes certain substances as carbonic acid gas, vapour, animal oily matters &c. and absorbs certain liquid & gaseous substances with which it is in contact. It contributes also much to the unity or [illegible] of the

-ermis of the body. It is the seat of special sensations, and the [illegible] of the organs become [illegible], numerous & not otherwise the general or diffused sensation of touch. But these latter are functions necessary for the most part foreign to the skin proper and which belong more particularly to the nervous system, to which the cutaneous serves as a means of protection.

4th The Excretion of Vapour & Sweat & the Secretion of Oily Matters. With regard to these I shall say but a few words; for I believe there is at the present day entertained a pretty uniform opinion respecting them. The insensible emanations from the surface of the skin were known to many of the older writers & various were the modes in which they demonstrated their existence. Eschenius is said to have collected [illegible] in bed, by previously oiling the sheets. The statical experiments of the great Sanctorius must not be passed unnoticed. He believes that the insensible perspira-

tion consists of watery vapour possessing certain nutritive qualities. Supposing a man took, in one day, into his stomach eight pounds of liquid & solid matter. Sanctorius allowed that three pounds passed off by stool & urine and the other five he laid to the account of insensible perspiration, calculating the evaporation from the lungs at one sixth of the whole. Cruikshank who instituted a series of experiments on this subject, would prove that, under ordinary healthy circumstances, there is lost by insensible exhalation 8 pounds 4 oz 56 gr, estimating the evaporation from the lungs at one fifteenth of the whole. But he is of the opinion however that a great deal enters by the insensible absorption which according to him taking place both in the skin & lungs. He moreover believes with Haller that electricity is transferred from the skin and as the electric fluid is now shown to be the same connection of the variations in the atmosphere

he has strongly insisted that it is the principal evacuation is insensible perspiration. The celebrated Edwards who has paid considerable attention to this subject does not agree with Sanctorius in supposing insensible perspiration to be entirely checked for three hours after a meal. He also differs with this gentleman & Mr Cruickshank respecting the proportion between cutaneous & pulmonary transpiration; and states it to be much more uniform from the lungs than from the skin being according to Lavoisier & Seguin a third of the entire amount of transpiration from the surface. Did space allow it would be pleasing to notice here the importance of insensible & sensible perspiration as means of depuration the suppression of which is often followed by the most fatal consequences. They seem to have as their prime object the equilibrium of the temperature of the body. The extent therefore & their & the importance of its functions render the due performance of the latter ~~in the action~~ of the first

consequence to the general health. The intimate sympathy which exists between every portion of the tegumentary system renders it necessary to the health of the individual that there should exist the most perfect anatomical & physiological integrity. Thus, the suppression of the cutaneous exhalation is almost invariably followed by an increase of exhalation of some of the mucous membranes, & this superabundance, probably, or either the internal congestion which takes place may be followed by inflammation - Such are the most frequent causes of Bronchitis & Pneumonia & many other affections. It would also be equally instructive to have given a brief notice of the sebaceous follicles & the oily secretions from them. It is the retention of this secretion on the skin which more particularly renders the latter unclean, impedes its function & gives rise or predisposes to cutaneous diseases & sympathetic disturbances in other organs of the body.

them, surround the terminating of the vessels, on a plane. There is continually going on a change of solids into liquids & liquids into solids. In this hand, in nature would not the terminating of the vessels themselves take part alternately, becoming fluid & solid. Besides we may ask with [illegible], who has seen these changes. His own mode of reasoning would recoil upon him to its entire & complete overthrow. The very reason he has adduced for rejecting the theory seen in the [illegible] of the Lymphatics may be then put with equal weight against the adoption of his own hypothesis, not to mention a host of others proving it absolutely untenable. Some anatomists have supposed the lymphatics communicated directly with the arteries and [illegible] & taking their origin open on the inner surface of the latter. There by injections have been made to pass from one to the other. But Magendie, I believe, was of the opinion that the fluids are merely deposited in

the surrounding arteries & are thence conveyed by the lymphatics & veins. But the following facts will at least go to prove satisfactorily the error into which Hunter had fallen that liquids do not penetrate the walls of the vessels & that there must be orifices through which substances passed within the vessels. In injecting, as is done in the lymphatics, the [illegible] Mascagni & [illegible] will [illegible] in these vessels the [illegible] was also seen in a coagulated state. Bleuland, Cruikshank Mascagni & Sommering have found also pus in the lymphatics. But it is the opinion of [illegible] others that pus can not, any more than blood, pass through the vessels [illegible] although it is not likely that the coagulated blood found in them was absorbed in that state, the fact is nevertheless very interesting because it proves that the blood has been taken up by the lymphatics together with its fibrine a substance that can never

pressure changes in cells in the vessels, especially those in [illegible] the lymphatics. Anastomosing [illegible] in the [illegible] vessels [illegible] but it is not probable that they were either transuded or [illegible] Milburn [illegible] them. In addition to these evidences the experiments of Cruikshank, Hewson [illegible] Magendie & [illegible] are all but sufficient. Enough has been said to prove the existence of valves at the extremities of the lymphatics. It remains now to ascertain the existence or non-existence of these orifices in the [illegible] about which there has been much dispute & contention. Space will not allow me to enter minutely into this subject; but in the first place, we may state as a thing certain that the function of the lymphatics is to absorb fluids, [illegible] it would not appear impossible that this absorption should take place [illegible] in contact with the [illegible]

or plunged into reservoirs containing it. The pressure of the [illegible] would fail to [illegible] the water would not ascend [illegible] instruments [illegible] beneath its surface. Such, I think, would be found to be the result in the case of the [illegible]. The same reasoning will [illegible], whether the power in these vessels to raise [illegible] depend uniformly on a capillary [illegible], or on [illegible] force inherent in the vessels themselves. Besides the reasoning of [illegible] on this point is very plausible & deserves to be noticed. Admitting for a moment that these vessels open on the surface of the epidermis, where there does not always exist fluids for the vessels to act upon, [illegible] in a column of air would not penetrate each ramification of the [illegible], since the power is in force, which caused the fluid to advance in them. What would be the natural consequence of this [illegible] or a less [illegible] atmospheric air, being admitted into

the blood itself, produces instantaneous death. Dr. C. gives a still more powerful proof than that against the existence of these orifices on the surface of the epidermis. He states, that he has proven in an incontestible manner that the lymphatics absorb with great avidity the vaccine matter, and that it is on this absorption depends the infection of the individual. Without a solution of continuity in the epidermis, the infection of the person will not take place. We are therefore led to conclude, that these orifices do not exist on its surface. This fact is interesting in another point of view, since some distinguished physicians of the present day believe it to be by sympathy, that an individual becomes infected with the vaccine matter.

After this examination I am inclined to admit the view which Dr. Richerand has taken respecting the orifices of the lymphatics. He says we should only look for them in the areoles of the tissues of

the cavities in the body, and as it regards the skin
particularly we would expect to meet with them
in the under portion of the derma. They may exist
in the middle & internal portions of the derma; &
that this is the case appears to be proved by the ac-
tion of some medicines when applied to a denuded skin.
But Prof. G. thinks their effects may be explained on
the principles of imbibition. He does not believe ei-
ther, as some modern physiologists do, that the
lymphatics open into cysts on the skin, for then the
mercury could be passed from the one to the other.
Besides he has impregnated the roots of the hairs
repeatedly with various matters & did not find on
even one place. I shall mention here, in conse-
[illegible] [illegible] [illegible] in one manner [illegible] [illegible]
the tracheas of insects do not exist in the skin of
man. They can not communicate with the combinat-
ion, for all the reasons would equally apply here
which were adduced against their [illegible] in the

surface is [illegible] may terminate in [illegible] & [illegible], & death would be the inevitable consequences. Besides we are [illegible] the cutaneous [illegible] than any other [illegible]

On the absorption of fluids by the Skin.

This subject has engaged the attention & pens of many of the ablest & most profound anatomists & physiologists; and yet how different are the opinions & conclusions to which their reasonings & experiments have led them. The reflection is truly depressing & appalling to a medical tyro & has no doubt contributed much to damp the fire & [illegible] the efforts of genius anxiously searching for truth, or aspiring after some honored abode in the temple of fame. Let it not, however, be supposed for a moment that I could be so vain & presumptuous as to select this subject with a view to a final decision, or even with a hope to shed additional light on this deba-

table ground. Let mine be the humbler yet pleasing & interesting task of recounting the labours of genius & industry, with a view to my own improvement. I desire to view the steps that have been trodden, to learn what is known & established, & what yet remains undecided — for that done I shall have made a small progress towards the attainment of the final object.

It is difficult to arrive at in the great [illegible] opinion with respect to the absorbing power of the skin. One thing I think we may state that many have drawn too general a conclusion from observations & experiments otherwise well made. Fontana & Mr Rousseau of Phila contend that the skin does not absorb at all or in a very slight degree. Dr Rousseau in particular comes to too sweeping a conclusion, one at least in which he is not warranted by his own experiments for they only prove that the oil of turpentine is not absorbed. This is equally true

is used from medicinal substances, has been proved by M. de Martigny & others. It appears also to have been satisfactorily shown by Drs Dunger-field & Knapp, that neither camphor, asparagus or garlic is taken into the circulation through the skin, and yet the radicals with which these articles are absorbed by the alimentary canal would prove that they were not improperly to the absorbents of the lymphatic vessels. In favour however of cutaneous absorption has been adduced the circumstance of some animals in humid climates drinking less but urinating as much as those inhabiting drier climates; that too of Sailors calming their thirst by bathing, or wearing wet clothes; and of an individual affected with Diabetes, who although he may drink nothing, will sometimes discharge enormous quantities of water. Besides, the propagation of the contagion of Small pox and other diseases has been brought forward to establish its existence;

Yet no one has proved that contagion is conveyed from body to body through the skin: but that it does not, seems to be rendered probable by the operation of vaccination as here no effect is produced unless the epidermis be raised. Other causes besides that consequent absorption may with great plausibility be assigned for the above phenomena and some of them exceedingly doubtful in point. I am disposed to allow them little or no weight in the consideration of this subject. — The augmentation of the weight of a person in bathing has been contended for by some & absolutely denied by others. Dr. Currie's experiment on a diabetic patient is entitled to no credit owing to the morbidly increased secretions of the kidneys &c. But we know that this distinguished gentleman made many experiments on himself, raising the heat of the bath from 87 to 96 degrees and in no instance did he find his weight augmented. Besides we

relates a remarkable case of hydrophobia. The death was the consequence of immersion notwithstanding every means to effect the restoration of the reclaimed subject. The patient on different occasions stripped perfectly naked upon Mr Cline's balance, immediately before immersion & directly after it, his body being previously dried. The weights remained unmoved during the whole of the experiments: But Mr Cline could not discern the slightest variation in the weight of the body. Tho the beam would have detected a single drachm, tho the immersion had been continued for an hour & constant friction kept up nearly the whole time with a view of increasing the action of the absorbents. Nor was the discovery of Mr Cline's the system could have influenced the result of the last mentioned experiment I shall not presume to decide. But on this point there are not wanted some of the most re-

cent experiments to which I refer, with opposite results. I allude to those of Dr. Collard de Martigny, and which seem to me as well and as satisfactorily conducted as any. By them it is ascertained that water [illegible] & which are dissolved some with greater the [illegible] with it, rapidity & [illegible] when satd, it was found that [illegible] substances are not acted on in a bath of cutaneous absorption. The experiments instituted by Dr. Madden Student of St Albans, & repeated by [illegible] have been cited by Dr Eichhorn as proving that a portion of the water of the bath is in fact absorbed. It appears from one of these experiments that if an individual remains two hours & a half in a warm bath containing extract of madder, rhubarb & curcuma the existence of these colouring principles may be demonstrated from 4 to 8 hours after in the urine, by means of carbonate of potash. The accuracy of this experiment can only be proved by repetition of it.

Were we to admit as proofs however, the various ex-periments made on animals & fishes? I think it would be a point clearly made out that there exists a power in the skin to absorb. All the experiments of Dr Alexander Monro on frogs go to prove, that in their opinion ardent spirits and essential oils are absorbed. The late Prof. Benj S Barton, from many observations was inclined to give credit to cutaneous absorption in frogs. In his account likewise of the Lacerta [illegible] we find a similar instance of this power. It is a well ascertained fact, says this ingenious naturalist, that the weight of many of the Amphibia, as the frogs particularly & likewise the lizards is very various at different times even in the same day or hour, and that this difference of weight is entirely independent of any aliment liquid or solid taken into the stomach but must be ascribed to the absorption of moisture &c.- The celebra

ted Edwards who has experimented largely on this subject believes in the absorption of water by the skin. In opposition to the opinion of Seguin he is disposed, as well from experiments on animals as from observations on man, to admit cutaneous absorption in water to an extent equivalent to the loss by transpiration in the same medium. This, if correct, will serve to explain the fact mentioned by Dr Currie of the weight of the body not being increased by bathing. Transpiration going on rapidly, if the weight of the body be the same after as before immersion there must have been absorption to compensate for the loss. Dr Edwards asserts also that absorption takes place in a humid atmosphere and the actual loss of weight, in such a medium is the difference between the loss by transpiration & the gain by absorption the former process exceeding [illegible] the latter. In opposition to this view however [illegible] [illegible], after his

covering, that absorption in man is most rapid in those parts of the body where exhalation is greatest. remarks, that while exhalation is going on there is no absorption; that absorption is diminished during exercise or by an increase of temperature & that it is increased by a depression of temperature, or by the evacuation of blood. In short cutaneous absorption is influenced by every particular in the inverse ratio of cutaneous exhalation. — From the swelling of the skin in the bath, & the atmosphere when humid & several other circumstances Dr Eichhorn is of the opinion that certain aqueous solutions enter by the process of imbibition. The quantity is he thinks small but is difficult to be determined, owing to the deperdition which takes place at the same time from the lungs &c. According to him the watery fluids alone are admitted or such as are capable of softening & expanding the epidermis. Oils have

not possess the requisite properties & consequently do not enter. This latter view agrees in part with the result of Mr. [illegible] Edwards's experiments: But it is the opinion of Mr. Bostock that the pulmonary absorption is carried on by a special & selective action of the [illegible].

Although it appears that the weight of authority is in favour of the opinion that certain fluids are taken in by the skin, yet it has been shown, there are not wanting those physiologists who entirely deny the existence of such a power. Even among its advocates there exists a great diversity of opinion respecting the man[illegible]ly ascertained & the laws by which the process is governed. It should moreover be kept in mind, that Amphibious animals are widely different in their anatomical character, ways of life and economy, from man; and consequently it is difficult to state how far an analogical reasoning [illegible]

to some curious experiments & inquiries on this subject. —

On the exhalation & absorption of gases in Cutaneous Respiration.

On this point up to the present there has existed a great contrariety of opinion among the physiologists and on some points is it not indeed unsettled. But my present province is to know what is known. Ingenhousz & Lavoisier believe that air is continually issuing from the skin. Count de Milly however particularly the air that is seen to rise in bubbles on immerging the body in water & states it to be azote & carbonic acid gas. Professor Woodhouse & some others were of opinion we ought to look to the water as the only source which can yield the air constituting these bubbles. According to these gentlemen the caloric heat from the body, which was the subject of experiment, expanded the

gas contained in the water used, & thus caused the bubbles to escape visibly from the surface of the skin. In support of this view an experiment is given which was made by holding the arm previously invested with varnished silk being impervious to air, in a vessel of pump water. In a short time innumerable globules of air were seen by himself & friends to be formed on the external surface of the silk and gradually to arise to the top of the water. It is further corroborated by the experiment of Dr Priestly in water exhausted of its air. There not a single bubble was found to arise from the surface of the skin although the immersion was continued for a considerable length of time. The experiments of Cruikshank on the contrary would prove that something passed off with the insensible perspiration rendering air fixed and he was of the opinion that the

vapour of insensible perspiration was similar in character to that expired from the lungs. I have recently investigated the power of the skin to absorb in some cases. But here I will mention that Dr Priestly denies that air is contaminated by animal perspiration as it is by respiration: and that the experiments of Seguin lead to results, the very reverse of those of Mr Abernethy the experiments of Bartholin, Spallanzani, Sir J. Humboldt, Provencal & some others, have been brought forward by Dr Beddoes to prove, that gases are absorbed: or, at least that oxygen is. When, for example, the hand is put under a bell glass, filled with oxygen, isolated from the atmosphere air by a mercurial bath, & permitted to remain several hours, it will be found, on examination that oxygen is absorbed & carbonic acid is present, which latter is due to the secretion of the skin. Such analogical reasoning has

been employed to prove the respiratory function of the skin. It has been shown by many experimenters & especially by Dr. Edwards, that some reptiles, whose lungs have been extirpated, continue to live many hours, and absorb more oxygen by the **surface** of the body, than they did before by the lungs; and that they die in a very short time if covered with spirit varnish so as to prevent the oxygen from entering; Spallanzani experimented on reptiles and Humboldt on fishes. Having, enclosed their **bodies** in different receivers so as to exclude them effectually from the atmosphere, whilst their heads were out & they breathing with ease both these gentlemen observed in the several apparatuses a diminution of oxygen & the presence of carbonic acid gas. The experiments of Dr. Edwards, however, demand most attention & confidence. They are very ingenious & appear to be entirely satisfactory; but they are

too numerous & detailed to be introduced into an essay of this nature. They have placed beyond a doubt the existence of cutaneous respiration in certain orders of beings. The Batrachia, Sauria, Ophidia & Chelonia, all receive the vivifying influence of the atmosphere through the medium of their envelopes. The pulmonary respiration is sufficient to maintain the life of some of them in summer, but not the others. Some would seem to suffer more from the loss of their cutaneous, than their pulmonary respiration. As, for instance lizards in summer die in a few hours if they are reduced to the necessity of breathing by the lungs alone & the vivifying action of the air on the skin be suppressed. This latter peculiarity is observed to an equal extent in many of the batrachia as the frogs and toads. Among the other proofs of the existence of cutaneous respiration, was the presence of carbon

ne acid which invariably accompanied the exper-
iments of Mr Edwards' conducted always so as to pre-
vent the lungs from interfering with the cor-
rectness of their results. Reasoning from anal-
ogy therefore we should be induced to believe
that a similar power resided in the skin of
man; but the difficulty in determining the
question in this manner is exceedingly great
and occasions much doubt. —

Spallanzani & others have pretended to have ascertain-
ed that hydrogen, azote & carbonic acid were
even taken into the system through the skin,
tho in small quantities. It appears to be well estab-
lished, however, that neither azote nor carbon-
ic acid penetrates the skin from without;
and as to hydrogen so great is its affinity for
vegetable & animal matter, it is very likely
that a small portion may either pass out or
be imbibed. It is apparent nevertheless, it is passed

is ascertained of the lungs, viz. that oxygen passes in & that carbonic acid is given out from the skin. But I believe I am [in my views] entirely original as to the manner in which this function is performed.

It will be recollected that we stated the mucous or albuminous tissue is converted into Epidermis by the process of oxidation. It is evident [illegible] that this oxidation should not exist to the same extent throughout its thickness. The most external layer of the epidermis being in immediate contact with the atmosphere, & which is continually falling off or desquamating, is most oxidized. From this, the oxygen passes by chemical attraction to the second portion of the epidermis or endermis proper, & then communicates with the mucous or albuminous; the consequence of which is the subsequent solidification & transformation

of the mucous membrane [illegible] exposed to the atmosphere the same degree of oxidize-ment is observed, and he moreover contends, that the mucous membrane undergoes a degree of oxidizement so slight, as to leave its fluidity & transparency [illegible] unabsorbed still preserved. The above phenomenon will, he thinks, account also for the formation of carbonic acid: For, as the oxygen penetrates chemically the whole substance of the skin, it will necessarily combine with the carbon, in contact with which it is now brought & thus form carbonic acid, which is, says he, incessantly disengaged from the skin. In support of this view of the subject, Dr Dickinson has cited some experiments, which had for their end the whitening of a negro's skin by means of Chlorine. His arm being subjected to the action of this gas, the skin assumed a white colour entirely mi

oxygen it would not have been conserved & been absorbed by organic power in the contrary this membrane would have been speckled only with white. As confirmatory likewise of his views he adduces the experiments of Spallanzani. By these it is proved that animal bodies & the various organs entering into their composition as the muscles nervous fibre &c. do absorb oxygen even after death: this mode of accounting for the passage of oxygen through the skin will by Dr Eichhorn be found more in conformity to the nature of things without having recourse to the admission or calling in the aid of that which has never been proved to exist viz. particular pores or vessels destined for the absorption of the gas.

As to the plausibility of Dr Eichhorn's reasoning, and the extent to which we are to receive as correct or probable his theory of particular for

mation, and that of carbonic acid, I shall not pretend to decide. The great simplicity & the originality of the view, which he has taken of the subject, were the principal circumstances that recommended it to my consideration. I have thought proper to introduce it at the conclusion of this essay: but to scan its merits would be a task for too responsible for me, and must devolve on the more learned & experienced.

Let me here repeat, that, in the selection of this subject, I was actuated by a desire to know what had been done to elucidate its mysteries, & only promised myself a better & more extensive acquaintance with it, than it was likely I should obtain, did I not write on it. I flatter myself, I have in part accomplished my object, but have deeply to regret, that there now hangs around it so much obscurity & uncertainty. Experiments, that would establish beyond a

doubt the true structure & functions of the skin, constitutes a desideratum in Medicine, and would be replete with the most interesting & important consequences. There is here presented a field for inquiry, that invites to cultivation - Whose great treasures & numerous beauties are as yet undiscovered, & can not but promise an abundant & fruitful harvest to the fortunate & successful labourer.